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Proceedings of the Pacific regional peer review on the pre-COSEWIC assessment of Southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) populations

March 6-8, 2013
Nanaimo, BC

Chairperson: Sean MacConnachie
Editor: Mary Thiess

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Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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SUMMARY

These Proceedings summarize the relevant discussions and key conclusions that resulted from a Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS) Regional Peer Review meeting held March 6-8, 2013 at the Pacific Biological Station in Nanaimo, B.C. A working paper focusing on a pre-COSEWIC review of data relevant to the assessment of status for populations of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) was presented for peer review.

In-person and web-based participants included DFO Science, Ecosystem Management and Fisheries Management staff from regional and national offices, as well as staff from the Province of BC, members of the southern BC Chinook Technical Working Group and external participants from First Nations, the commercial and recreational fishing industries, and environmental non-governmental organizations.

The conclusions and advice resulting from this review will be incorporated into the Research Document, which will be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website. Note that because this is primarily a presentation of data, there will not be a Science Advisory Report (SAR) generated from this process.

Compte rendu de l'examen par les pairs de la région du Pacifique sur l'évaluation pré-COSEPAC du saumon quinnat du sud de la Colombie-Britannique

SOMMAIRE

Le présent compte rendu résume l'essentiel des discussions et conclusions de la réunion régionale d'examen par des pairs de Pêches et Océans Canada (MPO) et du Secrétariat canadien de consultation scientifique (SCCS) qui s'est tenue du 6 au 8 mars 2013 à la station biologique du Pacifique de Nanaimo, en Colombie-Britannique. Un document de travail portant sur un examen pré-COSEPAC des données pertinentes pour l'évaluation du statut des populations de saumon quinnat (*Oncorhynchus tshawytscha*) du sud de la Colombie-Britannique a été présenté aux fins d'examen par les pairs.

Au nombre des participants qui ont assisté à la réunion en personne ou par conférence Web, il y avait des employés des bureaux régionaux et nationaux du Secteur des sciences, de la Gestion des écosystèmes et de la Gestion des pêches du MPO, des représentants de la province de la Colombie-Britannique, des membres du groupe de travail technique sur le saumon quinnat du sud de la Colombie-Britannique ainsi que des participants externes des Premières Nations, de l'industrie de la pêche commerciale et récréative, et d'organisations non gouvernementales de l'environnement.

Les conclusions et avis découlant de cet examen seront intégrés au document de recherche, qui sera rendu public sur le site Web du Secrétariat canadien de consultation scientifique (SCCS). Il est à noter que, comme il s'agit principalement de la présentation de données, aucun avis scientifique ne sera rédigé dans le cadre de ce processus.

INTRODUCTION

A Fisheries and Oceans Canada (DFO) Canadian Science Advisory Secretariat (CSAS), Regional Peer Review (RPR) meeting was held on March 6-8, 2013 at the Pacific Biological Station in Nanaimo to review data relevant to a pre-COSEWIC assessment of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) populations.

The Terms of Reference (TOR) for this data review (Appendix A) were developed in response to a request from the Species at Risk Act (SARA) office for a review of data that could inform a COSEWIC assessment of southern BC Chinook. As the primary agency responsible for holding data and information on aquatic species, it is standard practice for DFO to make this data available to COSEWIC so that they may undertake an assessment to determine if the species is at risk of extinction as defined by SARA. This pre-COSEWIC assessment is the first step in the SARA recovery planning process. Notifications of the science review and conditions for participation were sent to representatives with relevant expertise from DFO Fisheries Management, Science and Ecosystem Management branches, First Nations, commercial and recreational fishing sectors, environmental non-governmental organizations and academia.

The following working paper was prepared and made available to meeting participants prior to the meeting (an abstract is provided in Appendix B):

Brown, G. et al. Pre-COSEWIC assessment of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) populations. (*CSAP WP2012/13-P23*)

The meeting Chair, Sean MacConnachie, welcomed participants, reviewed the role of CSAS in the provision of peer-reviewed advice, and gave a general overview of the CSAS process. The Chair discussed the role of participants, the purpose of the various publications that will result from this process (Proceedings and a Research Document), and reviewed the definition and process around achieving consensus decisions and advice. Everyone was invited to participate fully in the discussion and to contribute knowledge to the process, with the goal of delivering scientifically defensible conclusions and advice. It was confirmed with participants that all had received copies of the Terms of Reference, Agenda and working paper.

The Chair reviewed the Agenda (Appendix C) and the Terms of Reference for the meeting, highlighting the objectives and identifying the Rapporteurs for the meeting. The Chair then reviewed the ground rules and process for exchange, reminding participants that the meeting was a science review and not a consultation. The room was equipped with microphones to allow remote participation by web-based attendees, and in-person attendees were reminded to address comments and questions so they could be heard by those online.

Participants were reminded that everyone at the meeting had equal standing and they were expected to contribute to the review process if they had information or questions relevant to the paper being discussed. In total, 36 people participated in the RPR (Appendix D). Nic Dedeluk was identified as Rapporteur for the meeting.

Participants were informed that Diana Dobson, Carrie Holt and Jake Schweigert had been askedto provide detailed written reviews of the working paper to guide discussions during the peer-review meeting. Participants were provided with copies of the written reviews.

The conclusions and advice resulting from this review will be incorporated into the Research Document and provided to COSEWIC to inform their assessment process. Research Document will also be made publicly available on the Canadian Science Advisory Secretariat (CSAS) website.

OVERVIEW OF SOUTHERN BRITISH COLUMBIA CHINOOK SALMON PROCESS

Mark Saunders, the manager of the Salmon and Freshwater Ecosystems (SAFE) division, provided an overview of process currently underway to assess populations of southern BC Chinook, both in terms of COSEWIC and Wild Salmon Policy (WSP) assessments. The process of where we are today was initiated several years ago. Chinook were facing several pressures and therefore questions around the status of Chinook were raised. It was recognized that it is not just one stock/status unit that is of concern, but many could be facing similar pressures. It was also noted that the solution needs to be bigger than just DFO.

The current process started July 2012 with the drafting of overall process timelines and governance structure. This work was taking place at the same time as DFO and others (i.e., the Cohen Commission) were trying to understand what was going on with Fraser River Sockeye salmon. It was recognized that a broader process was going to be required for Chinook. The first step was a bilateral meeting with First Nations, the next was a multi-lateral meeting open to other partners and stakeholders as a multi-faceted group that could comprehensively address all the concerns surrounding southern BC Chinook salmon.

There is now an effective steering committee that meets every three months. This committee is in the process of morphing into a planning committee – collectively around fisheries, habitat and hatchery-related issues. In addition, there is the southern BC Chinook Technical Working Group (TWG) – co-chaired by Gayle Brown and Mike Staley. The TWG has been working together for over a year. Mary Thiess and Steve Baillie are also working with this group at present.

This work will carry on past this meeting. Work on the status and technical matrix, WSP benchmarks, etc. are yet to come. In May, there will be an independent science review panel process which will hear presentations on status, bottlenecks, etc. for two days. During a third day (immediately following the two-day meeting) the panel will deliberate on the information presented and they will be responsible for completing a report on their opinions.

In November 2013, a CSAS meeting is scheduled to deal with WSP status assessment. This is a very big job that will never be perfect and the authors have had to keep the process moving forward. They chose to be pragmatic with resources, etc. and treat this as an iterative process rather than holding off until the product was perfected.

PRESENTATION OF WORKING PAPER

On behalf of the co-authors, Gayle Brown, Steve Baillie and Mary Thiess presented an overview of the working paper, Pre-COSEWIC assessment of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) populations (*CSAP WP2013-P26*). The working paper abstract is included in Appendix B.

Points of Clarification

Participants questioned the treatment of "other removals" in the escapement data. Treaty-related catch goes into the Treaty database, while FSC goes into a separate database. Treaty and FSC catches are not same from a First Nations perspective.

Other data sources than NuSEDS contain FSC catch information. In the Fraser, this data is not brought into NuSEDS. Therefore question again. Is NuSEDS the right place to store this type of data?

Participants also questioned whether the NuSEDS database is achieving its purpose for data census units? Relatively speaking, yes. Method information is documented, and changes can be assessed from the database. There are exceptions, and escapement surveyors are not able

to do multiple methods consistently, but there is often enough overlap to calibrate the methods used so they can be compared. When this occurs, data is aggregated.

There was considerable discussion around the calculations included in working paper *Table 9. Percent distribution of estimated CWTs (2000-2011)*. Changes in sampling rate over time (due to fisheries restrictions, for example) mean that exploitation rates cannot be compared directly (these calculations must account for variable sampling rates). A bigger sample from a fishery than in past years means it is a reduced source of uncertainty, but you need to be well-acquainted with the data in order to interpret the results properly.

WRITTEN REVIEWS

DIANA DOBSON

A copy of this review can be found in Appendix E. The reviewer presented a verbal summary of her comments to the participants.

Authors' Response

It was unclear to the authors what information should be included in a pre-COSEWIC report. There is a standard TOR for all pre-COSEWIC meetings, regardless of species being considered. The authors adopted the approach that if information was available in some form that could be defined at the CU level, then it was deemed useful and should be included in the working paper. Available information that provided an average value at the life history type, age, or multi-CU level was deemed to be less useful for this paper. The authors used examples of other pre-COSEWIC papers as guides for what had been presented for other species in similar processes. Some of these papers were like no other paper they had seen before – offering no conclusions, and no recommendations.

The purpose of this paper is to summarize available information and outline any data methods used, not to draw conclusions or portray DFO's opinion on the information presented. There is no comment on CU status in this working paper (nor should there be). The paper is a bit of a strange beast and the authors are unsure if they hit the mark or not. If there were any conclusions, we may want to draw back on that as that was not the purpose of the paper. Identification of factors affecting each CU, enhancement being one of those topics, was a purpose of the paper. Enhancement has been addressed for years, and the authors are not aware of any papers that review enhancement in BC. COSEWIC does require information about supplementation activities, although there are some categories of supplementation that COSEWIC has chosen to disregard.

Further Discussion

There was considerable discussion among participants about the suitability of NuSEDS as a data source. As an example, the reviewer found erroneous survey method information (e.g., fence count data on streams/rivers that never occurred) included in the working paper summaries. Many errors were noted by the reviewer when cross-checking data. It was pointed out that it was not the authors' responsibility to error-check NuSEDS. It is an Area responsibility to ensure the most current information is included in NuSEDS. Authors may need to note that these types of errors are possible and discuss the possible implications—it could be noted as a considerable source of uncertainty. It was also noted that there were various approaches the authors could take with this data, and the authors felt they made decisions that allowed them to compile and present the most complete and consistent dataset possible at this time. If significant errors remain, it is hoped that identification of these will motivate all users of NuSEDS to work to fix them.

NuSEDS is meant to provide a standard for each of the methods. NuSEDS is not a bullet-proof database. NuSEDS was set up to capture data for analysis by those who know what they are dealing with. It requires expertise to use, and must include assessment of the available metadata. COSEWIC needs to understand these limitations and if they are unable to find someone with sufficient expertise to work within these limitations, then they should not take on this review. It will be necessary to provide a narrative or some type of document to COSEWIC that explains the data limitations. The geographic extent of this review (35 CUs rather than 1 or 2) is definitely a concern. It requires some level of standardized data summary and/or analysis which may not be feasible with the lack of consistency across sites in NuSEDS. Need to be able to assess bias in the data—it either needs to be unbiased, or consistently biased.

This is our chance to understand and evaluate what will be given to COSEWIC. This process is meant to take it from raw data to a useable form with an outline of what needs to be considered in order to assess the COSEWIC criteria. If there is insufficient data then that needs to be documented.

The authors should add a helpful descriptive section for each CU (in Appendix A of the working paper) that describes which sites are included and why. For example, list the sites included as well as the sites excluded (and why). Describing uncertainty is critical.

COSEWIC can do trend analysis itself, but DFO should have their own assessment in case there is disagreement with COSEWIC's results. DFO must be able to provide "the" source of data with noted limitations, rather than have COSEWIC compile their own information from other sources. It is the obligation of the authors to point out systematic weaknesses in the data.

A participant noted that the work discussed above is a huge undertaking and wondered if there is a representative subset of data that can be used instead. The populations that have the best information are from coded-wire tagged stocks and other indicators (which are generally considered "enhanced"). Once CWT stocks are excluded, there are very few truly wild stocks left with quality data, which complicates the analysis of wild stocks under the WSP or any analysis using COSEWIC's supplementation criteria.

The authors noted that they struggled with the shear scope of this work and the expectations. In the past, focus was on a much smaller, well-defined case where lots of time could be spent on data and how to compile it (methods could be case-specific, rather than generic to all cases). This project is so large that there was not time or resources to generate specific methods for each CU. A real naive reader will be mis-informed, however, if you are familiar with the details, you will be able to pick up these changes in method.

Participants were reminded that once a species has been assessed by COSEWIC it will be re-assessed at least every 10 years. It would be nice to get the methods worked out now so it can be replicated more easily in the future.

The authors noted that for the most part, this is the dataset that is routinely used annually in Chinook Technical Committee work. More effort can be put into cleaning the data, but it is already being used for Canada – US analysis.

CARRIE HOLT

A copy of this review can be found in Appendix E.

The reviewer provided a revised version of the working paper with tracked changes to the authors.

Further Discussion

Participants discussed issues around enhancement and how it is was characterized in the working paper. COSEWIC has a working definition of enhancement that excludes it from analysis if there is a "net positive" effect resulting from it. Unfortunately, it is difficult (or impossible) to determine the net benefit of enhancement on southern BC Chinook salmon, but it is widely known that large scale enhancement activities have taken place. Additional commentary is needed in the working paper to explain the categorical levels of enhancement that were used in the working paper.

DFO does not have enough money to survey all areas where Chinook spawn. How to apply the Precautionary Principle in this case? At what level do you apply precautionary measures?

For habitat measures such as extent of occupancy, the full analysis was not possible, but the data could be provided for COSEWIC contractors to do the calculations.

Additional work needs to be done to investigate the effects of infilling methods used in the working paper. It is too much work to apply on a case by case basis. A systematic method is needed that can be applied consistently across all CUs. Participants suggest adding comments when data is missing with recommendations on how to mitigate impact.

A participant questioned the methods used to compile the escapement data. When runs are reconstructed by DFO, they use different methods that are optimized by area. No single method works best across all the areas being considered here. Are you going to go with indicator streams or 70% data or 40% data? What are the methods? To elaborate on the use of the Precautionary Approach – NuSEDS has categorical bins set up so that, for example, the fence counts will not differ by a factor of 2 from one year to the next. However, if you are using another method it may vary by a factor of 3 – 9. There are calibration methods to describe the differences, and then you can interpret if you are being too precautionary. It does not matter which method is used as long as the same standards are applied over time. The metadata must be incorporated. Pick a standard approach and stick to it. The trick is to figure out how to calibrate one method against the others and show what bias exists. Systemic issues are not the authors' responsibility.

JAKE SCHWIEGERT

A copy of this review can be found in Appendix E.

Further Discussion

The group discussed the question of whether southern BC Chinook had a residence as defined by COSEWIC. There are citable references that determine salmon redds are residences according to the COSEWIC definition. The question is whether there are any other known residences for Chinook. Participants discussed whether the act of juveniles defending their territory qualifies that territory as a residence. The authors were directed to investigate whether there is any literature documenting this behaviour. If so, it should be included in the paper.

Participants also discussed the suitability of CUs as DUs. The approach the authors took tried to take the most efficient route that could satisfy COSEWIC's DU approach as well as the WSP's CU approach. It is possible that the CUs may be divided or amalgamated by COSEWIC to form DUs. In the case of Fraser River Sockeye, CUs were treated as equivalent to DUs for COSEWIC purposes.

GENERAL DISCUSSION

General discussion was structured around the elements of the standard pre-COSEWIC Terms of Reference (see Appendix A).

LIFE HISTORY CHARACTERISTICS

- Richard Bailey to provide half a page around variations in juvenile life histories and behaviours for interior BC CUs: are these differences across CUs or within CUs?
- The authors should include growth parameters, (e.g., length at age data):
  - Body size may change over time and affect fecundity, is there a trend?
  - Considerable amount of data in grey literature, lots of data in spreadsheets, no generic bio-traits database exists in DFO
  - Indicator data is collected, but indicators are hatchery fish—can we use hatchery CWT data to represent wild?
    - Time of return and fecundity is a phenotype which can be affected by hatchery rearing.
    - There is covariance in body size trends between hatchery and wild.
    - There has been no assessment of this relationship in maturation rates.
    - Wild stocks from WCVI return larger and older than hatchery fish.
    - Hatchery release timing is different from wild migration timing, results in different utilization of lower river and estuary (need to be clear that using hatchery indicators to represent wild populations requires assumptions and there is uncertainty and differences that are not well understood).

Further Discussion

- Genetic structure of unenhanced systems is different from the genetic structure of the enhanced system (which includes both enhanced and unenhanced fish).
- There is a wide range of levels of enhancement and subsequent impacts for Chinook.
- There was considerable discussion around including information about historical DFO management units (MUs) and assessment framework in the Threats section. Historically, management units, not CUs, have been used to assess status. This has changed over time though – already provided a CU link to Integrated Fisheries Management Plan (IFMP) as salmon management framework.
- Ricker identified impact of fisheries on age/size structure of fish returning to river – it would be a huge piece of work to assess these trends.
- Need to include discussion of assessment methods—explain differences between hatchery and wild populations, CWT program assumptions, etc.
- If discussion of assessment framework helps with methods, then it is useful and should be included, otherwise not.
- It is unclear how COSEWIC will assign designatable units (DUs), assume it will map directly to CUs, but this is not certain.

- There is a lack of consensus around population structure. Uncertainty should be captured in Appendix A for each CU.

COSEWIC CRITERIA

A. Number of Mature Individuals (Total Spawners)

- This report uses relative escapement estimates rather than estimates of total abundance – COSEWIC wants to know total adult spawners.
- COSEWIC specifies three generations in their guidelines which means the working paper's focus on the period after 1995 is generally okay for this part of the analysis.
- More data is better though – as long as changes in methods/people over time can be indicated, clearly explained, and accounted for in the methods as well in each CU commentary.
- There is also an appropriate subset in some CUs where we have higher confidence (i.e. consistent bias) – e.g. sentinel stock program.
- Data goes back to 1953 in many cases, even further in a few other cases.
- Using escapement exclusively, you can miss trends in productivity – for example, marine survival trends can capture density-dependent variation in productivity.
- For two CUs we have productivity time series that will be included.
- For this report, should we use a generic cut-off of all data from 1995 forward, or set a CU-specific start year? There are good pre-1995 estimates for some CUs – e.g., Healy's work in the early 1980's, interior BC CUs in the earlier 1990's are also good. Pre-1975, most data is very unclear in terms of enumeration methods and estimate quality. Some estimates are very good (and well-documented), others are not. Volume of data to process necessitates a systematic approach to filtering good data from bad (i.e., data quality criteria/rules that can be applied across all CUs).
- Studies could be used to anchor data back to 1980s.
- If there are long time series they will be used by COSEWIC to add context.
- If there is high abundance in the last three generations but not historically, this information will be considered in the COSEWIC status assessment.
- Must remember that this work is also meant to be the foundation for a WSP status assessment, which includes long term indicators. Understanding long term trends can influence the assessment of more recent, short term trends.
- Fishing pressure confounds changes in escapement in long term trends. You need an estimate of absolute abundance.
- In the report, it is not clear which sites were excluded from analysis in report, and why. Some of the sites included had large numbers of gaps – note that in the Fraser Sockeye case, they only included sites with no more than 7(?) years missing data. Authors should re-visit this criterion.
- With respect to infilling, in the Fraser Sockeye case, sensitivity analysis demonstrated that gap filling did not affect trends, so it is unclear if gaps even need to be filled. The authors should consider assessing the effects of infilling on trend results.

- Concern about lumping sites with gaps with those without gaps. Is lack of comparability an issue?
- Aboriginal Traditional Knowledge (ATK) and Local Ecological Knowledge (LEK) may support pre-1995 data, or not.
- Overall, there are 419 sites across 35 CUs – COSEWIC will need the CU trend data in electronic form, not by individual sites (i.e. COSEWIC will need the compiled data, not raw data estimates).
- Participants questioned the methods used to impute values prior to creating aggregates. It was suggested that a potential approach could be to use a subset of NuSEDS sites then conduct data standardizing routine. As a final step, run sensitivity analyses to determine which data should be included.
- Participants sought clarification on the source of raw data, e.g. NuSEDS or NuSEDS plus additional sources. There was concern about the repeatability of the analysis if the sources were not well documented.
- The group discussed the timeframe for incorporating reviewed and/or updated data back into NuSEDS. The operational guideline is that if it is not in NuSEDS, it does not exist.
- Drawing from the Fraser Sockeye project, they identified which sites was pulled, then included narrative about why sites were included or excluded. For example, the resolution may be different over time (e.g. one survey site becomes 5 survey sites later in time), then use gap filling routines to make them additive. This then becomes a repeatable process.
- The group discussed the effort required to undertake a similar exercise for southern BC Chinook (with many more CUs than Fraser Sockeye being considered) versus available resources and pending deadlines. It was determined that everything would need to be complete by the end of May 2013.
- The group discussed the need to infill missing data points. Since the methods used to infill have been peer-reviewed and published, COSEWIC could do their own infilling, provided the methods used are fully explained. [COSEWIC representative later indicated that COSEWIC would not have time or resources to implement an infilling algorithm.] Additional infilling work has been completed by area staff, but these are not in a readily accessible format with necessary metadata to support their widespread use.
- Concern was expressed over the acceptability of this working paper. If the data sources and methods are a problem, then the paper will not be accepted. With a WSP status assessment scheduled for November, will the data and methods require further review at that time? This may impact the deliverability of the WSP status assessment. Preliminary results suggest that the trend estimates generated are not sensitive to process.
- The working paper does need to describe more fully the extent and distribution of data gaps, indicate which streams in an aggregated set have data, data treatment methods, etc. The COSEWIC representative indicated that there does not appear to be sufficient information provided for COSEWIC to conduct their assessment at this time. More work will be necessary. Ideally, COSEWIC would like to receive one comprehensive dataset integrated to the CU level. Otherwise, they may implement their own (misinformed) integration approach. DFO participants indicated that this may be difficult to provide, given the lack of comparability between CUs in terms of data quality and quantity. With the extensive geographic scope of this project (35 CUs), need to be able to apply a

systematic assessment framework, not deal with individual spreadsheets for each CU with individual methods applied and assessed for each.

- The participants discussed what would constitute data deficient (DD) at the site and CU levels? If there is insufficient data to do trend analysis then automatically DD?
- The group reached consensus that a second CSAP process (working paper and peer review) will be required. Sensitivity analysis of trends will need to be conducted and included in the follow-up report, to assess the impact of gap-filling method implemented and any additional data treatments applied. It was determined that a subgroup would meet on the third day scheduled for the current peer review process to discuss additional work required on the data review and treatment methods.
- It was acknowledged that a CSAP review of Fraser CUs was conducted in 2007 and has been updated annually to 2010, but this information is not in NuSEDS. Similar algorithms could be applied, all methods appear to be relatively robust and provide similar results.
- There was further discussion of the CU to DU process. COSEWIC subcommittee has met to discuss this issue. The WSP work requires data at the CU level. It could be that several CUs are combined to form DUs. It will be a question whether trends would be additive among CUs combined in DU or not. COSEWIC would have to decide which way to go on this issue.

B. Extent of Occurrence and Area of Occupancy (EO/AO)

- Watershed area and spawning length, obtained from Fisheries Information Summary System (FISS), working paper page 30, Table 7 – meets the requirement of TOR element 3b.
- Point data exists for most census sites in Blair Holtby's database (can be used to assess EO).
- There is a contractor project ongoing to quantify southern BC Chinook habitat that should be complete 6 months from now. Results could be reported in subsequent revisions to the working paper.
- Participants questioned whether change in extent over time is a concern. The CU dashboards show number of sites and how that number has changed over time (summarized by decade) from NuSEDS. This tally does not account for changes in survey effort over time. Budget reductions in the last 15 years have lead to decreased survey effort. LEK may be useful in this case as well.

C. Characteristics of Habitat and Threats to Habitat

- This information is summarized in the dashboards included in Appendix A.
- Data tables might also be useful.
- It was noted that the Threats section can create a lot of work, and is the most nebulous part of document. There is the additional challenge of linking threats to productivity. Is it meant to be a literature review exercise? Or limited to DFO information only? It was noted that the authors also need to scope, severity and likelihood of threat.
- Groundwater supply was a noted threat that is missing in the current working paper. This is particularly relevant to interior Fraser River CUs. Groundwater supply is critical for 9 months of the early Chinook salmon life cycle – extraction of groundwater and

development is likely the highest threat for some Fraser River CUs. Richard Bailey to provide additional text for working paper revisions.

- More information (and references) could be provided around the threat of invasive species and climate change (as a long term threat) as well (i.e. climate change impact on stream temperatures, ocean temperatures, increase in snow pack, winter temperatures, frequency of extreme events such as drought, fire and floods, severity of storms and how these will impact Chinook productivity/survival). Chrys Neville to provide additional references around climate change impacts on Chinook. Key is that authors must be able to specify the *effect* of the threat on Chinook (and provide published references, were available).
- The group suggested a number of other potential threats to be included in the working paper discussion:
  - Short term cyclic, decadal climate regimes (i.e. north/south shifts, PDO, responses of populations to all of the above).
  - Interaction of human activity with climate change (increased arctic shipping results in port expansion)
  - Loss of eelgrass (Levings or Birtwell) and kelp forests in Strait of Georgia – habitat alteration in nearshore e.g. port development, large scale temperature shifts, interactions with other species and management actions (e.g. not to fish pink salmon)
- The Habitat Report Card (Porter et al.) work needs to be referenced (double-check that it is included in list of references).

D. Threats

- The working paper needs to add more information around freshwater predators.
- **Enhancement**: There was considerable discussion of enhancement issues by participants. Many coastal stocks, including almost all of the indicator stocks, are heavily enhanced. Need to discuss the threats associated with high enhancement (with references).
- The working paper may also need to discuss the differences between COSEWIC and WSP approaches toward enhancement. For COSEWIC purposes, if supplementation has net positive or neutral effect on the populations, then it can be included in the assessment. For WSP, only fish who were born in the wild and whose parents were born in the wild can be included in a WSP status assessment (not all hatchery fish are marked though, so this is impossible to determine). Assuming an increased abundance for CU as a whole (including hatchery influence) is beneficial, is not the way to assess wild populations (i.e. for a WSP status assessment). Threats posed by enhancement include:
  - Genetic diversity: The fish will be most adapted to whichever environment (hatchery or wild) is most successful at producing spawners. The current program is better at assessing outmigrating juveniles than returning adults. In wild populations we do have a problem if hatchery fish spawn in unenhanced systems (i.e. hatchery strays). This is of great concern, particularly when the wild population in question is at a much lower abundance, as the hatchery influence may reduce the fitness of the wild population. WSP places value on biodiversity of CU, while hatchery strays decrease biodiversity in a CU. Unfortunately, data does

not exist to address this issue at present. The authors should include references to Cowichan and US studies on the negative effects on wild fitness of first generation hatchery fish spawning in the wild. Ruth Withler to provide additional text around threats from enhancement with respect to genetics.

  - If production is strongly reduced, this could be another threat [why?]
  - Loss of range, fewer redds constructed, wild fish loss of habitat, competition

- The authors need to provide additional rationale for the break points chosen in their categorization of enhancement (low-unknown, moderate, high).
- Higher level enhancement may have masked declines (e.g. Salmon R at Salmon Arm, where the groundwater supply is gone, but the general public is convinced there are salmon there because the hatchery puts them there).
- COSEWIC will need data relating to enhancement levels (where hatchery fish are present or not). It may not be easy to summarize this completely.
- There was additional discussion about stocks that would disappear if enhancement was stopped (can they be considered "persistent"?)
- What can the indicator stocks inform regarding enhanced or unenhanced stocks (e.g. survival rates, stray rates, other?) This could be added to discussion in working paper.
- The authors should consider adding more discussion about the use of thermal marking for enhanced contributions. Although the method is not well documented, and there is no standardized metadata around timing of sampling, strata being sampled (e.g. broodstock), it still shows great promise in providing a reliable mass marking tool. There is currently a request for science advice around the methods used to assess thermal marks, including estimation of bias between CWTs and thermal marks.
- Relationship between CWT indicator stocks and their associated CUs needs to be more clearly presented.
- **Fishery-related Threats:**
  - Authors should assess/discuss unregulated and unreported catch by CU, as well as compliance by CU.
  - Chuck Parken is expanding his watershed based habitat capacity for escapement targets and MSY to all southern BC Chinook in June 2013
  - Authors could consider using a Garcia plot to illustrate historically unsustainable yields (historically set at 2/3 of MSY to avoid high risk of managing to MSY, but perhaps higher at times?).
  - First Nations harvest is included in figure 9 – there should be discussion of it, what is included and how it is treated.
- **Marine Survival**: If marine survival is poor, regardless of human intervention, survival and productivity will be low. The authors should also discuss how poor regimes can impact returns; include assessment of early marine survival (reports in NPAFC publications).
- Are threats prioritized by significance? CUs will rank priority of threats differently. The working paper currently lists by life history stage only.

- **Marine Mammals**: can include additional information about impacts of orcas – good estimates of consumption when whales in critical habitats – includes uncertainty (i.e. information in winter is less certain). Andrew Trites may have data on seal scats. Note that these will only be relevant threats if they can be associated with human activities that have perpetuated/increased the risk of mortality (e.g. lights under bridges, placement of log booms, etc.), rather than natural predation. Threats are only those activities or influences that can jeopardize recovery of the affected species. It can be difficult to decide where to draw the line between ecosystem interactions and threats as defined here (i.e. impacts on other salmon species could pose threat to Chinook, such as a change in management practice on coho)
- The authors could make use of threat information presented during the Cohen Commission to structure this section.
- Note that each threat must be discussed with respect to scope, scale and severity, with references where available.
- The group decided it would be helpful to change the section name from "Threats" to "Limiting Factors".

CONCLUSIONS

Sections of the working paper that do not include CU-specific data summaries were accepted with revisions (namely sections relating to life history, habitat requirements, threats, and habitat threats). These sections will be combined into the revised research document, and renamed as "Part I". Sections of the working paper that dealt with escapement and enhancement data compilation and summarization require significant additional work and cannot be accepted at this time. The additional work required is to be completed as soon as possible and provided in a "Part II" research document that will be reviewed at a subsequent regional peer review process.

RECOMMENDED REVISIONS

PART I

1. Life-History Characteristics
    - Need to add further discussion about the complexity of Fraser River Chinook juveniles, e.g. non-natal rearing habitat range and varying ocean distributions (Richard Bailey and Chuck Parken to work on expanding this section).
    - Need to add growth parameters: Body size (length-at-age info, etc.)
    - Need to add information about fecundity, generation time, etc.
    - Data is available, but not in a comprehensive database or from published sources necessarily. Add references where available; acknowledge there are considerable unpublished data and the relative importance of these.
    - Additional data sources:
        - **Hatchery data**
            - Most report average egg size: Ratio of number of eggs per female can provide average fecundity by length (individual fecundity is not assessed).

- **Creel surveys, Carcass surveys, CWT length data** (parameters would need to be re-calculated by age class).
- **Albion test fishery**
  - Age, lengths, fecundity data collected. Life-history information can be referenced.
  - Albion data is a continuous and ongoing source of information (can be used to detect trends over time?). Majority of the data is not available by CU/stock though.
  - Could be provided as a reference for Fraser CUs.
- Generation time: Calculate average generation age by brood
  - Shows a downward trend (average generation declining to younger age).
  - Could be accompanied by other information such as size at age and average age at return.
  - Have a signal, next stage is what is causing it (but this is not the focus of this data review report).
- For all data sources, need to describe/summarize the data available, discuss its time span, representativeness, strengths and weaknesses, any method changes over time, existence and treatment of missing data, etc. Some sources may require significant work to compile, but there may be long term value in doing it.
- Need to discuss how management units map to conservation units—if they do?

– Add a sub-section on Assumptions & Uncertainties to emphasize what is still unknown and what assumptions are being made to compensate for lack of knowledge.

2. Review of Designatable Units
   – Need to include more description of Holtby and Ciruna methods from 2007 and more discussion on new genetic information since 2007.
   – Include CU table, with a column to highlight the basis for each CU designation (ecotypology, genetics, life history, etc.).
3. COSEWIC Criteria
   – Deferred to Part II paper.
4. Habitat and Threats to Habitat
   – This section requires more work, particularly to identify features and functions of important habitat for Chinook salmon.
   – Add section on ground water dependence (Richard Bailey to contribute this).
   – Expand the discussion of marine habitat: nearshore/high seas habitat, Fraser River (use Chuck Parken and Richard Bailey's work on offshore habitat as an example); Chrys Neville to contribute information? (e.g. discuss impact of logbooms, development, etc. on habitat quality).

- Try to incorporate text that identifies and/or quantify (unpublished) grey literature that exists on habitat threats.
- Freshwater Habitat Report Cards
    - Move to Part II paper.
    - Include more discussion on methods and approach used.
    - Include disclaimer on limitations (i.e., the indicators chosen are not necessarily correlated with Chinook productivity).
- Climate change
    - Include more discussion on potential climate change impacts to water quality and quantity (temperature, freshet timing, peak flows, snowpack levels) and affect on Chinook habitat.
    - Natural variation vs. climate change: Compare to long term climatic shifts (PDO, ENSO, etc.); different ecotypes will respond differently to changes.

5. Residence
    - Incorporate slides from the presentation into the working paper (state explicitly that salmon redds have been accepted as residences, as defined by SARA) and include references (i.e., Fraser Sockeye salmon work, others?).
    - Juvenile territory was determined not to be a residence as there is no energy expended to construct it (it is defended through behaviour though). The authors could discuss and add references, but conclude it is not a residence as defined by SARA.
6. Threats and Limiting Factors
    - Need to identify threats or limiting factors, and indicate spatial scope of threat, potential severity of threat and likely duration of effects or time to reverse or resolve.
    - The authors could consider including habitat threats here rather than in section 4.
    - Marine mammal predation should be included as a limiting factor (not a threat)
        - Mainly biology (intra-specific interactions)
        - Impacts: due to changes in management practice, protection/change in protection for seals
    - Enhancement
        - Need to include additional references.
        - Include discussion of impacts from hatcheries that produce a different life-cycle than that of the associated wild population.
        - Analyses of this will be in Part II paper; general discussion can remain in Part I with reference to further analysis to be included in Part II.
        - Fisheries Impacts
            - Needs more discussion and description (based on published methods).

        - Update figure labels where "Total mortality" should say "Total Fishing Mortality".
        - Include reference to information as part of CU summaries.
    - Invasive species
    - Aquaculture
    - Interactions between threats should also be considered where possible (e.g., enhancement may be less of a threat in the absence of harvest pressure).
    - Should try to identify specific threats for each CU where possible
7. Other Information
    - Narrative information should be included here.
    - Incorporated information that has little/no data (e.g., LEK/TEK)
        - Example: Haida database—developed with geo-referenced records (not part of geographic extent of southern BC Chinook?); allows search for specific references (e.g., traditional halibut grounds); multiple events give increased certainty
    - Discuss management framework and key changes over time
        - Example: 1995 – escapement enumeration responsibilities changed (changes to census sites as a result).
        - Example: Decreased fishing pressure on Coho in the 1990s translated into increased pressure on Chinook.
        - Could present in a timeline table (management changes, pressure shifts (direction), fishing regulation changes, PST milestones, etc.)
            - This type of table could contain many, many layers.
            - This would likely be more relevant in the paper that aims to provide advice (WSP assessments and/or strategic planning)

PART II

Part II paper will include:

- Escapement data analysis:
    - Primarily to be able to provide numbers to COSEWIC for their assessment (Criteria 3a).
- Hatchery and coded wire tag indicator stock information.
- Sensitivity analysis of data treatments on trend results.
- Ideally, will include complete review of methods (citable) so it will not have to be reviewed from the beginning at every subsequent southern BC Chinook meeting.
- Will need to fit follow-up review into existing WSP status assessment and Strategic Planning timelines.
    - Data workshop scheduled for April 17/18
        - Will expand on metrics applied; with input from relevant experts.
        - Focus to be on data methods and analysis.
    - WSP CSAP paper to be reviewed in November.
    - June CSAP for Part II – need to produce the data for COSEWIC

- Abundance information is the key requirement for COSEWIC to be able to proceed with its assessment.

– Analysis is important too, but more so for later WSP assessment, not immediate COSEWIC purposes.

– Need to separate what COSEWIC needs and DFO needs are (and deadlines) and then prioritize.

ACKNOWLEDGEMENTS

The authors acknowledged the contributions of many individuals that enabled them to meet the very tight deadlines of this process (John Ford, Peter Olesiuk, Strahan Tucker, Chrys Neville, Marc Trudel, Richard Bailey, Cheryl Lynch. The Chair thanked the rapporteur (Nic Dedeluk) and several others who provided their notes to assist the rapporteur (Cheryl Lynch, Sabrina Crowley, Tom G. Brown and Mary Thiess).

APPENDIX A: TERMS OF REFERENCE

Pre-COSEWIC Assessment for Southern British Columbia Chinook

Regional Peer Review - Pacific Region

March 6-8, 2013
Nanaimo, BC.

Chairperson: Sean MacConnachie

Context

The implementation of the federal *Species at Risk Act* (SARA), proclaimed in June 2003, begins with an assessment of a species' risk of extinction by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC is a non-government scientific advisory body that has been established under Section 14(1) of SARA to perform species assessments, which provide the scientific foundation for listing species under SARA. Therefore, an assessment initiates the regulatory process whereby the competent Minister must decide whether to accept COSEWIC's assessment and add a species to Schedule 1 of SARA, which would result in legal protection for the species under the Act. If the species is already on Schedule 1 of SARA, the Minister may decide to keep the species on the list, reclassify it as per the COSEWIC assessment, or to remove it from the list (Section 27 of SARA).

Vancouver Island, Sunshine Coast, and Fraser Chinook are currently being assessed by COSEWIC. Fisheries and Oceans Canada (DFO), as a generator and archivist of information on marine species and some freshwater species, is to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of a species can be undertaken.

Pre-COSEWIC reviews normally try to provide information for the categories: 1) Life history characteristics; 2) Review of designatable units; 3) Review the COSEWIC criteria (COSEWIC, 2010); 4) Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat; 5) Describe, to the extent possible, whether the species has a residence as defined by SARA, 6) Threats; and, 7) Other. Life history characteristics;

Results of this Regional Advisory Process (RAP) will be made available to COSEWIC, the author(s) of the species status report, and the co-chairs of the applicable COSEWIC Species Specialist Subcommittee.

Objectives

The overall objective is to review available DFO information relevant to the COSEWIC criterion to assess a species risk of becoming extirpated, endangered or threatened.

One working paper will be developed to address the following specific items:

1) Life history characteristics

- Growth parameters: age and/or length at maturity, maximum age and/or length
- Total and natural mortality rates and recruitment rates (if data are available)
- Fecundity
- Generation time
- Early life history patterns
- Specialised niche or habitat requirements

2) Review of designatable units

Available information on population differentiation, which could support a COSEWIC decision of which populations below the species' level would be suitable for assessment and designation, will be reviewed. Information on morphology, meristics, genetics and distribution will be considered and discussed.

See COSEWIC 2008 "Guidelines for recognizing Designatable Units below the Species Level".

3) Review the COSEWIC criteria for the species in Canada as a whole, and for each designatable units identified (if any).

COSEWIC Criterion – Declining Total Population

a. Summarize overall trends in population size (both number of mature individuals and total numbers in the population) over as long a period as possible and in particular for the past three generations (taken as mean age of parents). Additionally, present data on a scale appropriate to the data to clarify the rate of decline.

b. Identify threats to abundance— where declines have occurred over the past three generations, summarize the degree to which the causes of the declines are understood, and the evidence that the declines are a result of natural variability, habitat loss, fishing, or other human activity.

c. Where declines have occurred over the past three generations, summarize the evidence that the declines have ceased, are reversible, and the likely time scales for reversibility.

Criterion – Small Distribution and Decline or Fluctuation: for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

a. Summarise the current extent of occurrence (in km²) in Canadian waters

b. Summarise the current area of occupancy (in km²) in Canadian waters

c. Summarise changes in extent of occurrence and area of occupancy over as long a time as possible, and in particular, over the past three generations.

d. Summarise any evidence that there have been changes in the degree of fragmentation of the overall population, or a reduction in the number of meta-population units.

e. Summarise the proportion of the population that resides in Canadian waters, migration patterns (if any), and known breeding areas.

COSEWIC Criterion – Small Total Population Size and Decline and Very Small and Restricted: for the species in Canada as a whole, and for designatable units identified, using information in the most recent assessments:

a. Tabulate the best scientific estimates of the number of mature individuals;

b. If there are likely to be fewer than 10,000 mature individuals, summarize trends in numbers of mature individuals over the past 10 years or three generations, and, to the extent possible, causes for the trends.

Summarise the options for combining indicators to provide an assessment of status, and the caveats and uncertainties associated with each option.

For transboundary stocks, summarise the status of the population(s) outside of Canadian waters. State whether rescue from outside populations is likely.

4) Describe the characteristics or elements of the species habitat to the extent possible, and threats to that habitat

Habitat is defined as "in respect of aquatic species, spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced".

The phrasing of the following guidelines would be adapted to each specific species and some could be dropped on a case-by-case basis if considered *biologically* irrelevant. However, these questions should be posed even in cases when relatively little information is expected to be available, to ensure that every effort is made to consolidate whatever knowledge and information does exist on an aquatic species' habitat requirements, and made available to COSEWIC.

a. Describe the functional properties that a species' aquatic habitat must have to allow successful completion of all life history stages.
In the best cases, the functional properties will include both features of the habitat occupied by the species and the mechanisms by which those habitat features play a role in the survivorship or fecundity of the species. However, in many cases the functional properties cannot be described beyond reporting patterns of distribution observed (or expected) in data sources, and general types of habitat feature known to be present in the area(s) of occurrence and suspected to have functional properties. Information will rarely be equally available for all life history stages of an aquatic species, and even distributional information may be missing for some stages. Science advice needs to be carefully worded in this regard to clearly communicate uncertainties and knowledge gaps.

b. Provide information on the spatial extent of the areas that are likely to have functional properties.
Where geo-referenced data on habitat features are readily available, these data could be used to map and roughly quantify the locations and extent of the species' habitat. Generally however, it should be sufficient to provide narrative information on what is known of the extent of occurrence of the types of habitats identified. Many information sources, including Aboriginal Traditional Knowledge (ATK) and experiential knowledge, may contribute to these efforts.

c. Identify the activities most likely to threaten the functional properties, and provide information on the extent and consequences of those activities.
COSEWIC's operational guidelines require consideration of both the imminence of each identified threat, and the strength of evidence that the threat actually does cause harm to the species or its habitat. The information and advice from the Pre-COSEWIC review should provide whatever information is available on both of those points. In addition, the information and advice should include at least a narrative discussion of the magnitude of impact caused by each identified threat when it does occur.

d. Recommend research or analysis activities that are necessary.
Usually the work on the other Guidelines will identify many knowledge gaps. Recommendations made and enacted at this stage in the overall process could result in much more information being available should a Recovery Potential Assessment be required for the species.

5) Describe to the extent possible whether the species has a residence as defined by SARA

SARA s. 2(1) defines Residence as "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating."

6) Threats

A threat is any activity or process (both natural and anthropogenic) that has caused, is causing, or may cause harm, death, or behavioural changes to a species at risk or the destruction, degradation, and/or impairment of its habitat to the extent that population-level effects occur. Guidance is provided in: Environment Canada, 2007. Draft Guidelines on Identifying and Mitigating Threats to Species at Risk. *Species at Risk Act* Implementation Guidance.

List and describe threats to the species considering:

- Threats need to pose serious or irreversible damage to the species. It is important to determine the magnitude (severity), extent (spatial), frequency (temporal) and causal certainty of each threat.
- Naturally limiting factors, such as aging, disease and/or predation that limit the distribution and/or abundance of a species are not normally considered threats unless they are altered by human activity or may pose a threat to a critically small or isolated population.
- Distinction should be made between general threats (e.g. agriculture) and specific threats (e.g. siltation from tile drains), which are caused by general activities.
- The causal certainty of each threat must be assessed and explicitly stated as threats identified may be based on hypothesis testing (lab or field), observation, expert opinion or speculation.

7) Other

Finally, as time allows, review status and trends in other indicators that would be relevant to evaluating the risk of extinction of the species. This includes the likelihood of imminent or continuing decline in the abundance or distribution of the species, or that would otherwise be of value in preparation of COSEWIC Status Reports.

Expected Publications

- Proceedings
- Research Document

Participation

Participation is expected from:

- DFO Sectors (Science, Oceans, Habitat and Species at Risk)
- Aboriginal Communities
- Province of British Columbia
- Academia
- Industry
- Non-government Organizations
- Other Stakeholders
- COSEWIC status report author
- Members of COSEWIC (Co-Chairs and/or SSC experts)

References Cited

COSEWIC. 2010. COSEWIC's Assessment Process and Criteria.

APPENDIX B: WORKING PAPER ABSTRACT

Some Chinook salmon populations (*Oncorhynchus tshawytscha*) from southern British Columbia, entering the ocean south of Cape Caution, have experienced repeated years of low spawner escapements and there is a high degree of uncertainty about their longer term abundance and productivity. These populations are currently scheduled to be assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2014. Concurrently, Fisheries and Oceans Canada (DFO) is undertaking several initiatives in order to assess the current status of these stocks and to guide the implementation of the Wild Salmon Policy (WSP) for these populations. This paper compiles and presents the best available information possessed by DFO on life history traits, trends in the abundance and distribution of this species, as well as factors affecting abundance in southern British Columbia for the development of a status report for COSEWIC. The available data, presented for 33 conservation units of southern BC Chinook salmon, indicate as suspected that trends in spawning returns of large-sized Chinook are declining for many CUs in southern BC. Declining or persistently low cohort survival rates for a some of the coded-wire tag indicator populations, along with corresponding declining trends in fishery exploitations rates, indicates a trend in reduced productivity in the last three generations. Abundance for some CUs has been increasing, while for others, data are insufficient to draw conclusions about trends in abundance.

APPENDIX C: AGENDA

Regional Peer Review Meeting (RPR)

Pre-COSEWIC assessment of southern British Columbia Chinook salmon (*Oncorhynchus tshawytscha*) populations

March 6-8, 2013

Pacific Biological Station
Nanaimo, BC

Chairperson: Sean MacConnachie

DAY 1 - March 6, 2013

Time	Subject	Presenter
0900	Introductions Review Agenda & Housekeeping CSAS Overview & Procedures	Sean MacConnachie
0915	Review of Terms of Reference as pertains to research document	Sean MacConnachie & RAP Participants
0930	Presentation of Working Paper	Authors
1030	**Break**	
1050	Questions of Clarification	RAP Participants
1100	Presentation of Reviews & Authors' Responses	Reviewers & Author(s)
1200	**Lunch Break**	
1300	Review of designatable units	RAP Participants
1430	**Break**	
1450	Life history characteristics	RAP Participants
1600	**Adjournment**	

DAY 2 - March 7, 2013

Time	Subject	Presenter
0900	Review of Day 1	
0930	Review COSEWIC criteria by area	RAP Participants
1030	**Break**	
1050	Habitat and threats to habitat	RAP Participants
1200	**Lunch**	
1300	Threats to species	RAP Participants
1430	**Break**	
1450	Residence and distribution	RAP Participants
1600	**Adjournment**	

DAY 3 - March 8, 2013

Time	Subject	Presenter
0900	Review and follow-up on unresolved issues	RAP Participants
1200	**Adjournment**	

APPENDIX D: PARTICIPANTS

Last Name	First Name	Affiliation
DFO		
Bailey	Richard	SA Fraser-BCI
Baillie	Steve	SA South Coast
Brown	Gayle	Science SAFE SA
Brown	Tom G	Science SAFE
Candy	John	Science SAFE
Dedeluk	Nic	Science
Dobson	Diana	SA South Coast
Fraser	Kathryn	Science SAFE
Gayle	Rupert	SFAB
Grant	Sue	SA Fraser-BCI
Hargreaves	Marilyn	Science CSAP
Holt	Carrie	Science SAFE
Houtman	Rob	Science SAFE
Hyatt	Kim	Science SAFE SA
Irvine	Jim	Science SAFE
Labelle	Mark	Science SAFE
Lewis	Dawn	Science SAFE SA
Lynch	Cheryl	SEP RHQ
MacConnachie	Sean	Science MEAD
MacIsaac	Erland	Science SAFE
Miller-Saunders	Kristi	Science SAFE
Neville	Chrys	Science SAFE
O'Brien	David	SA South Coast
Parken	Chuck	Science SAFE SA
Patten	Bruce	Science SAFE SA
Sawada	Joel	Science SAFE SA
Schweigert	Jake	Science MEAD
Thiess	Mary	Science SAFE
Tompkins	Arlene	Science SAFE SA
Trudel	Marc	Science SAFE
Whitehouse	Timber	SA Fraser-BCI
Withler	Ruth	Science SAFE
External		
Ayers	Cheri	Cowichan Tribes
Blackbourn	David	Retired DFO
Bocking	Bob	LGL-Maa-nulth FN representative
Crowley	Sabrina	Nuuchahnulth First Nation
Happynook	Tom	Maa-nulth First Nations
Ma	Brian	ESSA Technologies
MacDuffee	Misty	Raincoast
Rosenberger	Andy	Raincoast
Sinclair	Alan	COSEWIC
Wilson	Tim	Compass Resource Management

APPENDIX E: WRITTEN REVIEWS

DIANA DOBSON

The authors were given the not insignificant task of compiling, in a very short time period, relevant DFO data to support the scheduled COSWEIC assessment of Southern BC (SBC) Chinook. In terms of the scope of this exercise, there are two key issues:

1. DFO holdings for data relevant to COSEWIC assessments are extensive; ranging from thousands of coded-wire tag, catch and escapement records to watershed specific habitat assessments found in consultant reports related to stock assessment or restoration work, habitat referrals, etc. It is not a simple task to determine what information is relevant, or how to present the information in a way that provides enough background for a third-party consultant tasked with applying the data to a status assessment.
2. The problem of scale. SBC Chinook encompass several different management units and each contains multiple conservation units. Although there are global similarities in life history, data, status trends, and threats among the management / conservation units, there are in many cases unique patterns and this variation cannot easily be captured through a large scale data review. It is not clear at what scale COSEWIC intends to inform the analysis.

Given these issues and the time-line, the authors have made an admirable attempt to interpret the task and summarize the available DFO data. However, I believe additional work is required in order to provide a more complete package with enough background and context so that an accurate COSEWIC assessment can be completed.

Some of the key issues:

- The paper should stick to its purpose, which according to the Introduction and TOR of this meeting is to summarize and review available DFO information relevant to the COSEWIC criteria for status assessments. The title of the paper, "Pre-COSEWIC assessment of Southern BC Chinook salmon populations" is somewhat confusing given this objective. It might be more appropriately entitled, "Summary and Review of DFO information relevant to the COSEWIC criteria for status assessments."
- The paper is incomplete with regard to describing data sets within DFO holdings that are relevant to the COSEWIC criteria. Some of these omissions may be related to the problem of scale. That is, data may have been omitted that are not widely available across CUs. Still, these data may be useful to an assessment biologist to help understand context – i.e. the extent to which threats are global versus local, which is a requirement of COSEWIC.
- The paper should more clearly describe the DFO data that were provided and the methods used to select and summarize the data set. A notable example is the criteria used for the selection of escapement data and the assessment of the quality of the estimates.
- In evaluating the appropriate application of the data provided, the paper should more clearly describe the uncertainties and limitations associated with each the data sets with respect to applying the COSEWIC criterion.
- There is no little discussion of the management or assessment frameworks used by DFO to manage and evaluate SBC chinook, which to in my opinion is essential context that

should be provided in either the Introduction and/or information provided for the assessment of Threats.

Overall, the format of the paper is confusing given the stated objective to summarize and review DFO data relevant to a COSEWIC status assessment. The paper essentially follows a COSEWIC status assessment report format. Perhaps as a result of using this format, it seems to depart from the stated objective in the TOR and waffles between summarizing and reviewing DFO data, compiling a literature review, and providing some assessment of the status and threats. The methods that were used to compile, select and evaluate the resulting data set are for the most part not described, with the exception of the classification of level of enhancement (Appendix D). The sources of uncertainty are rarely described and never in sufficient detail. Many conclusions are drawn with no or insufficient data provided. Therefore, it is difficult to review and evaluate this paper with regard to the standard questions posed to CSAP reviewers.

While the TOR clearly states the objective of the paper (i.e. review available DFO information with regard to COSEWIC assessment criteria), the authors seem to have more broadly interpreted the assignment and therefore go further and include a literature review and draw assessment conclusions. To be fair to the authors, page 2 or 3 of the TOR may be confusing in this regard: is the job to review the information categories, or, to provide and review DFO data relevant to those categories? This issue should be clarified. In my view, the paper would be much more useful if it focused on the latter task. (In any case, I am confused why the task would be to complete an assessment given a) there is a follow-up CSAP workshop scheduled to review the status of SBC Chinook and b) COSEWIC will hire a third-party consultant to conduct their review.)

If the paper is revised and rewritten more like a scientific paper (i.e. Introduction, Methods, Results, Conclusions/Recommendations), it would go a long way to address some of the specific concerns I raise below. The authors have already done a significant amount of work compiling the data. What seems to be missing is a clear description of how they compiled that data (especially in describing choices around what data has been omitted), how the uncertainty of the data is best described, and what the consequences of the uncertainty are (i.e. limitations of the data with regard to application to evaluating the COSEWIC criteria).

Proposal of a method for selecting data for status assessments (in relation to minimal data standards and data treatment) and subsequent review of the methods through a CSAP discussion / workshop would in fact serve DFO's objectives to further WSP implementation (as well as providing data for COSEWIC). From an Area Biologist perspective, there is significant confusion as to what the methods should be applied when compiling data of variable quality for application of WSP assessments. That is, within the department various treatments have been applied, but there seems to be little consensus on which method is the standard.

General Review

Is the purpose of the working paper clearly stated?

The purpose of the paper is clearly stated in the Introduction – i.e. "to present a summary of the most recently available information on Chinook Salmon". As described in the TOR for the meeting, these data are being summarized in order "to provide COSEWIC with the best information available to ensure that an accurate assessment of the status of the species can be undertaken." The overall objective of this paper/meeting is "to review available DFO information relevant to the COSEWIC criterion to assess a species at risk." There is a bit of a contradiction in here in the authors' interpretation, which apparently is to broadly compile data, and the TOR objective which is more narrowly focused on reviewing the available DFO information. Since, COSEWIC

So:

1. This is an exercise in compilation of DFO data; which implies some level of completeness or thoroughness in compiling and/or describing the available DFO data relevant to a chinook COSEWIC status assessment.
   Therefore, the key question for review: Is the DFO data set that was provided (or described) sufficiently complete?

2. The information that is compiled is the best available information, which implies some review / critique of the information that has been supplied. In the COSEWIC context, it seems particularly important to describe sources of uncertainty of the data.
   Therefore, the key question for review: have the sources of uncertainty in the DFO data been sufficiently described?

Are the data and methods adequate to support the conclusions?

1. More conclusions and recommendations should be made with regard to the summary and evaluation of the data provided:

The results from the review of the available data should form the key conclusions. That is, I would expect clear conclusions or recommendations around the use of data (e.g. potential limitations when applied to a specific analysis, etc.). I would also expect detailed discussion on the sources of uncertainty in the data. Although there is some discussion about data uncertainty (e.g. with regard to escapement data) it is mostly buried in the text. In contrast, I think a critical review of the data and methods used to select the data provided to COSEWIC should actually form the substantial component of this working paper.

2. Some of the conclusions that are made are not supported by data:

There are conclusions made within the paper that seem do not seem to be supported by data, particularly in the "Threats" section. One example that stood out was the discussion on enhancement activities. Although enhancement activities clearly need to be reviewed as a potential threat to wild salmon populations, conclusions are made about the specific threat caused by the practice of seapen releases, but no DFO data are supplied to support the conclusions. Appendix C, the list of seapen releases, does not support the conclusion, although it does describe the extent of the activity.

So this observation raises a few points:

- I don't think the objective of the paper is to assess the threats, but rather provide data (and qualification of the data) that would allow COSEWIC to assess the threats. (It may be that COSEWIC identifies seapen releases practices as a potential threat, but based on the data provided they would also be hard-pressed to draw a firm conclusion.)
- Much of the discussion on enhancement as a threat is pulled from the literature and does not specifically add DFO data relevant to the discussion. SEP managers often caution that the US literature on the negative effects of enhancement is based largely on US programs and may not accurately reflect Canadian results. They argue the integrated program delivered in Canada has not had as many negative effects as the segregated enhancement program practiced in the US. This perspective is not captured.
- In order to assess the degree to which enhancement practices have been a cause of wild salmon population decline in Canada or continue to pose a threat, some of the relevant information that should be provided by DFO to COSEWIC include:
  - Background about enhancement practices that have been utilized by SEP in relation to mitigating the negative effects of enhancement. The descriptive section

on enhancement could provide more details and be moved from the "population structure" section to the "threats" section.

- DFO data that allows an evaluation of how effectively SEP has achieved its operational objectives with regard to mitigating the negative effects of enhancement. For example, provide the data that shows how frequently either broodstock or hatchery contribution guidelines are met? (Some of these data are provided in Appendix D – e.g. CWT estimated contributions when available. However, there is a notable omission of relevant thermal (otolith) mark data.)

Are the data and methods explained in sufficient detail to support the conclusions?

One might interpret the Access database that has been developed through this paper as a sort of conclusion as it represents the data compiled for COSEWIC based on the author's assessment of the best available data. Appendix A represents a summary of the results of the key data that were compiled. However, for the most part there is little description of the methods used to select data or for that matter the methods used to collect the estimates. There is also very little description or discussion of the uncertainty or limitations of the data set. There are placeholders for a graphical representation of data quality in Appendix A, but no description of how data quality was determined.

Are the recommendations provided in a form useful to a fisheries manager?

This paper is not strictly intended to provide recommendations to a fisheries manager. However, it is intended to provide recommendations to COSEWIC for applying and interpreting DFO supplied data to their status criteria. From that point of view, much of the information that has been provided is useful. However, the paper does not describe the management or assessment frameworks that DFO applies with regard to SBC chinook and providing background and context of the management system would be helpful.

For example, both domestic and international harvest management objectives are associated with management units, which typically include multiple CUs. Our assessment frameworks were designed to assess the status of the management unit not the CUs within management units. While some of the relevant information is documented in the Regional IFMP and Chinook Technical Committee (CTC) reports, I think an overview of the management system should be provided. It would certainly help to understand the patterns of exploitation when assessing exploitation as a potential threat.

If this document is intended to provide advice to decision-makers, does the advice reflect the uncertainty in the data, analysis or process?

The "decision-makers" are presumably the COSEWIC consultant who will apply the data provided to a status assessment and then the COSEWIC committee who will evaluate the assessment. As already discussed, the uncertainty in the data and analysis are not sufficiently described in the methods or in a review of the results.

Can you suggest additional areas of research that are needed to improve our assessment abilities?

Some of the key sources of uncertainty or data gaps that will impede the ability of COSEWIC (and DFO) to assess of the status of SBC Chinook and their habitat are:

Escapement monitoring:

Two key issues:

1. More often than not, no attempt is made to quantify the uncertainty associated with escapement estimates summarized in DFO databases. Understanding the uncertainty

and bias associated with Chinook escapement estimates, has become a pre-occupation of the Chinook Technical Committee through recent studies operated under the Sentinel Stock Committee. It is curious there is only brief mention of this issue and no significant discussion of the results of these studies in this paper – seems like a major incongruity to me given the resources dedicated to the Sentinel Stock Program and the policy/assessment implications.

2. Lack of data and decreasing quality of escapement monitoring programs. Due to declining resources, both the quantity of systems surveyed and quality of surveys has been reduced in recent years. In any case, the existing assessment frameworks were not established with the objective of achieve representative samples across CUs.

Catch estimation:

Understanding the extent to which exploitation plays a role in population declines, requires more complete catch monitoring programs (including validation of catch estimates for accuracy and inclusiveness through evaluation of verification data and data provided through compliance monitoring programs).

Habitat / Ecosystem monitoring:

It is difficult to assess habitat threats (or inform management actions) on both a global and local scale without the existence of habitat monitoring programs. As the authors describe, the information presented in this paper is at best synoptic.

Specific recommendations for revising and completing this paper are described below.

Section Review

Population Structure

Much of this section a literature review, for the most part referring to data that are already published. This section could be shortened, especially by summarizing key information into tables. (I believe some of these tables have already been compiled in WSP related work – some of which is referenced in the text such as work done by R. Diewart.) There could be more focus should on further describing and evaluating the DFO data holdings that may not be readily available in the published literature. It seems important to identify any potential uncertainties with regard to components of the population structure data (or areas where they may be lack of general scientific consensus) and how those uncertainties may affect a status assessment or identification of threats.

Population Size and Trends

A) Generation Time/Age Classifications

I see no substantial issues with using CWT indicator stock data and CTC cohort analysis results to describe generation time and age composition within stock aggregates. However, I thought the discussion needs some clarification with regard to application across CUs. In the management system, the CWT indicator stocks are used to represent patterns of mortality, distribution and exploitation across the Management Unit, which includes several CUs. For example, the Robertson Creek Indicator stock is assumed to represent patterns across the entire WCVI management unit, which includes 3 CUs. The one-to-many relationship (or assumption) used in the management and assessment frameworks is not clearly communicated.

B) Escapement

The key data set provided was selected from the NuSEDs database. The authors identify limitations of the data included in the NuSEDs database and therefore exclude some of the data in the final database they have created for COSEWIC. However, the methods they used to select the data and qualify data quality are not at all adequately described. Therefore, it is difficult to review the methods. This is an area of the paper that needs significantly more work in both the description and discussion of methods applied to select data. Stepping back, this section also should describe the various methods used to generate escapement estimates and the uncertainty associated with those estimates. It should also provide recommendations of the use of the various estimates types in relation to COSEWIC criterion. For example, estimate type x is / is not suitable for trend analysis. If the estimate is suitable for trend analysis, over what time period has the method remained constant – i.e. the estimates from year to year are considered an index.

Without this level of detail it is difficult to review and discuss the methods in a CSAP workshop. Also, in reviewing a sample of the data summarized in the Access database, I noticed some major errors in the fields associated with "estimate type" for stocks. The data in these fields needs to be reviewed and corrected.

C) *Exploitation.*

Again, this section is wholly incomplete with regard to the data provided, description and context. Figure 5 is not fishing impacts as stated, but only a summary of stock composition in fishing regions. To understand fishing impacts, exploitation rate data need to be provided but these are provided only in the Threats section. The inclusion of the Exploitation discussion in the Population sizes and trends section is somewhat confusing. If the point of the discussion is to describe the abundance of the populations (not just the spawning population size), it should be more clearly made.

Distribution

Proxy data (watershed area and accessible spawning length of river) were used to describe chinook distribution. I was surprised the FISS database was not mentioned as a potential source of data.

Habitat Requirements

Like the discussion on "Life History", this is more of a literature review not compilation and evaluation of DFO data.

Threats

I already discussed the issue of conclusions not supported by data, above (e.g. the seapen discussion). What is also notable is the omission of some key potential threat categories. For example, why discuss seapens, but not potential impacts from finfish aquaculture? Also, the commentary on exploitation as a threat is incomplete. On the one hand, there should be more description on the use and limitations of fisheries mortality data provided for CWT indicator stocks. On the other hand, there is no discussion on issues related to exploitation. For example, what is the potential threat associated with exploitation due to illegal catch, non-reporting of catch, or lack of compliance with harvest regulations? I could go on.

Other

The TOR referred to the incorporation of other data that may be useful if time permits. In this paper there is no discussion of DFO's use of abundance-based benchmarks in Chinook management, such as the "habitat-carrying capacity" benchmarks developed by Parken et al.

and approved through the CSAP process. nThis work is informative because of the insight it provides into the general productivity of chinook populations (and also their ability to persist at relatively low population sizes).

Appendix B: Detailed Information on CUs

Similar to the rest of the paper, the method used to compile the data associated with the graphics or commentary is not described. I think many of them need review and discussion, but it is impossible to do this without an understanding of the compilation method. For example:

- Aside from the fact the "survey quality" graphics are incomplete; there is no description of the method used to assign survey quality.
- For many of the CUs, the escapement graphic presents trends across years of non-constant survey method with non-constant survey bias. I think this is misleading.
- There is no description of how survey effort effects the conclusions that may be drawn from the "distribution" graphic.
- For many of the CUs, I don't believe the commentary in the "Exploitation Rate" sections is accurate. For example, While the CU may not have a CWT ER indicator, in many cases the ER indicator for the management unit is (not could be) used to represent pre-terminal exploitation rate. There is no evaluation of whether or not this is a reasonable assumption, which would be useful for the COSEWIC assessment team.

Appendix D: Enhancement Related Categorization of Activity

This is one section where the method for describing enhancement activity is clearly described, although sources of uncertainty in the data are not. However, I think the method should be reviewed. It seems unnecessarily complicated. Why not just classify the level of enhancement according to the SEP objective – e.g. production (assume always high), rebuilding/conservation (assume always low to moderate)? There are few systems for which CWT data allows an estimation of the hatchery contribution to the spawning population. The frequency of the number of years with releases or brood removals does not convey that much information about the potential impact on the enhancement activity on the natural spawning population. There are more data available on the contribution of hatchery offspring to spawning populations (i.e. otolith mark sampling), but this was not included.

Recommendations for Revisions/Further Discussion

Structure/Format/Analysis:

- Structure the paper like a scientific paper so that the methods used in the selection and evaluation of the data set can be properly reviewed.
- Provide more background on the management and corresponding assessment framework.
- Provide further description on additional sources of DFO data that may be relevant to the status assessment – i.e. through a list of potential sources or even better through an annotated bibliography. The authors should not be expected to retrieve data from sources such as consultant reports or the HADD database, but the fact that these data and reports exist should be documented.
- Fully describe the methods used to select and evaluate the DFO data that were provided and associated with the COSEWIC criteria.

- Provide more detailed compilations of the data in tables. I find the CU summaries somewhat misleading.
- Discuss in detail the sources of uncertainty associated with the DFO data sets and provide recommendations on the limits of their application with respect to the COSEWIC criteria.

Editorial:

- The paper would benefit from an edit to remove typos and grammatical errors.
- In every section, the further use of tables to communicate concepts and data would be helpful – e.g. life-history traits (maturation rate, fecundity, etc.) should be tabulated. (There are many other places where information presented in text would benefit from more graphical display in tables, graphs or maps.)
- In many sections, further use of sub-headings would be useful – for example, I found the discussion of 'ocean' and 'stream' type chinook confusing and confounded.
- There are some errors in the information presented that should be corrected– e.g. ocean type chinook may smolt in periods shorter than 60 days. There are others errors; including some I noticed in some of the specific data provided for CUs in both the summary and ACCESS database.

CARRIE HOLT

CSAP Working Paper 2012/13-P23

March 6-8, 2013

This document provides a comprehensive review of spawner and exploitation rate data for southern BC Chinook available at DFO, as well as threats to this species and its habitat, as required by COSEWIC. The authors should be congratulated on the large amount of information they have pulled together in a short time-frame.

Major Comments

1. The abstract provides a brief, qualitative summary of status and trends in abundances. However, this summary information is not found in the text. Additional quantitative summaries would provide rigor to these, somewhat vague, conclusions. For example, declines in survival from smolt to age-2 were observed for 3 or 11 indicators stocks over the last 3 generations, and average survival rates for that period were <5% for 9 or 11 indicator stocks (from 27 Feb version of Figs). However, it's not clear how to interpret the average survival rates smolt-age2 without an estimate of total survival and fecundity (i.e., in general, will a 5% survival rate smolt-age2 result in recruitment below replacement levels?)
2. The differences between the terms: population (as used in this paper, and as defined by COSEWIC), subpopulation, census sites, site, and locations (as defined by COSEWIC) are important, but are not clearly distinguished in the document. For example, population is defined by COSEWIC as "the total number of individuals of the taxon" (or DU). In contrast, in some instances, population is used to describe units within DUs (CUs) in the manuscript. Subpopulation is defined by COSEWIC as "geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less)", and is used in COSEWIC criteria B and C. Locations are defined slightly differently by COSEWIC, "a geographically or ecologically distinct area in which a single threatening event can rapidly affect all populations of the taxon present. This size of the location

depends on the area covered by the threatening event [the most serious plausible threat] and my include part of one or many subpopulations", and is used in criterion B (interchangeably with the term subpopulations) and criterion D. Also, are census sites the same as sites in this paper? And are census sites equivalent to COSEWIC's definition of subpopulation (and/or locations) ? The current definition and aggregation of census sites seems to be *ad hoc* and without biological rigor (p.26, par.3). The definition of these sites/subpopulations/locations is critical for the application of criteria B, C, and D. distributional criteria for COSEWIC populations

a. As a side note, for southern BC Chinook salmon, what is the most serious plausible threat and how would you define location? For sockeye salmon in the Fraser River, de Mestral Bezanson et la. (2012) identified the most serious threats as those at the watershed level (e.g., due to forest fires, landslides, chemical spills, or other human activities near water), and defined locations as "individual streams or lakeshores used regularly by spawning salmon" (de Mestral Bezanson et la. 2012, p.3).

3. For the review of DUs (p.20), an explicit statement that CUs represent DUs is required. In addition, a concise summary of the methods used by Holtby and Ciruna to identify CUs for Chinook salmon (biogeoclimate zones, genetics, and life-history characteristics such as...) would be helpful. Identification of DUs is a critical step in the COSEWIC assessment process, a step that may be highly scrutinized for SBC Chinook considering the relatively large number of DU. Some justification that definition of CUs aligns with that for DUs would be valuable for COSEWIC.

4. A glossary defining all terms and acronyms (including those used in Fig.1) would be helpful.

5. CU groups in Table 2 are not defined, and are confusing. I suggest combining Tables 2 and 3 and aligning information by CU. Currently, it does not look like the information is consistent between the two tables (e.g., Boundary Bay has 3 small PIP hatcheries according to Table 2, but Table 3 lists 1 (census site?) with "High Enhancement" and 0 (census sites?) with "Low-Moderate Enhancement" for Boundary Bay).

   a. How are "Low-Moderate" and "High" levels of enhancement defined, and how was this definition chosen?

   b. Also, I suggest including definitions of/guidelines for PIP and CEDP in terms of quantitative levels of enhancement/production they typically provide. How closely are these guidelines adhered to? I noticed that the last assessment of hatchery operations was almost 10 years ago (2004/5) (p.18).

   c. Do hatchery facilities in any CU use broodstock from another CU? This information will guide COSEWIC in how to analyze the data.

6. Can the authors provide any guidance (even qualitatively and/or with uncertainty) to COSEWIC on how to assess if enhancement has had a net positive impact on the CU (e.g., in terms of productivity)? Again, this information will guide COSEWIC in how to analyze those data.

7. What are the implications of not infilling data when summing incomplete time-series of sub-populations within CUs? It is possible that large gaps in dominant sub-populations at the beginning or end of the time-series will erroneously result in declines or increases in abundances when sub-populations are summed. There is no way to assess these possibly large biases given the current data. In lieu of infilling (if time is insufficient), I

suggest providing time-series of individual sub-populations within each CU in Appendix A (possibly within a single plot per CU) so that analysts can investigate such biases.

8. The data is provided in graphical form in Appendix A, but numbers are not provided. Although the text states that an Access Database will be made available to the authors of the COSEWIC status report, is there a requirement that it be made available publically (as tables in another Appendix) for outside analysts to view?

9. What quantitative criteria were used to exclude census sites from a CU and why (p. 26, par.3)? The reference to Holtby and Ciruna (2005) in that paragraph is ambiguous. If some data are ignored, COSEWIC will need to know why.

10. Fig. 4 provides the landed catch in various regions, and Fig. 5 provides stock composition in each region. However, I think more important are the temporal trends in catch originating from each region within SBC (i.e., are catches of Chinook originating from FR, WCVI, or GS declining over time), which could be derived from data within those 2 figures.

11. Can you provide approximate expansion factors (or a plausible range of expansion factors) for relative abundances reported by CU. Absolute abundances are required for criteria C and D. As currently displayed, several CUs are depleted below thresholds described in those criteria, but this may be an artifact of missing data. If no expansion factors are provided, then COSEWIC may treat them as absolute numbers to be precautionary.

12. The section on Extent of Occurrence and Area of Occupancy includes data on number of watershed within CUs. What order catchments are these? De Mestral Bezanson et al. (2012) use 1st and 3rd order catchments. Are the ones used here consistent with those? Are these watersheds/catchments meant to encompass both spawning and freshwater rearing habitat, or just spawning? Is CU spawning length a proxy for Biological Area of Occupancy (as described in de Mestral Bezanson et al. 2012)?

13. In some places, the manuscript provides inappropriate management recommendations beyond the scope of this Pre-COSEWIC assessment. They are vague, not well justified, and should be omitted. (e.g., p.31, last sentence of par.2, p.32, last sentence of par.4, and p.33 last sentence of par.2)

14. For marine habitat requirements and marine threats, will increased competition on the high seas from large increases in hatchery-reared populations from across the North Pacific result in changes to prey availability and density-dependent effects on Chinook salmon? This possibility has been identified for a number of salmon species/populations, and may be relevant to SBC Chinook as well.

15. For threats to the freshwater environment, several pressure indicators are identified based on their ability to induce changes in environmental conditions (p. 34) and derived from Stalberg et al. (2009), but it's unclear to what extent (if at all) these pressures impact salmon productivity. Also, the pressure indicators in Table 8 are not aligned with any of the metrics in the habitat report cards in Appendix A. The text states that metrics were developed from Indicators identified in Table 8, but the indicators seem more like metrics (e.g., % estuary foreshore alteration as a Pressure Indicator, Table 8). A description of how Porter et al. (2013) adapted these indicators and/or the co-authors of this report synthesized them to the 11 metrics considered here is warranted. In addition, a description of benchmarks selected should be included in the text (I see them only as a footnote to Habitat Report Card).

16. The section on threats from enhancement needs some rewording. The authors correctly identify that separating hatchery-origin from neighbouring wild-origin populations is a false dichotomy (p. 35, last par.). However, the authors include the conclusions of Gardner et al. (2004), who do not recognize this false dichotomy when describing hatchery impacts on wild fish. For example, Gardner et al. (2004) describe genetic changes in hatchery-origin fish, and their impacts on wild fish, when in fact, they are part of the same genetic population.

17. Are there any threats to juveniles in the estuarine or coastal environments through changes in habitat (e.g., cover from predators) or predators (e.g., birds of prey) that can be included in the Threats section?

18. There are numerous missing components in the document, as specified from the Terms of Reference. While some components rely on data not currently available or easily accessible at DFO others are, such as several life-history characteristics (growth parameters, length at maturity, and fecundity). Also, have recruitment time-series been reconstructed for some CUs or sub-populations? If so, those should be included.

    a. Data to assess distribution according to COSEWIC criterion on small distribution and decline or fluctuation are not provided in a format that can be readily applied. Is it possible to at least provide the names of the catchments within CUs, which can be used in future analyses of Area of Occupancy calculated from the area of catchments. Also geo-referenced locations of census site would be valuable for future analyses of Extent of Occupancy.

19. Where possible, it would be valuable if the authors could provide an estimate of the imminence of each identified threat, magnitude of impact, spatial extent, frequency, and the strength of evidence that the threat will actually cause harm (p.3-4 of Terms of Reference), even if only in relative terms (i.e, ranking among threats). Note that the Terms of Reference state that naturally limiting factors such as predation should not be considered a threat if they have not been influenced by human activities. This may be the case for killer whales.

20. The Terms of Reference requests the identification of 'residence' (as defined by COSEWIC). Note de Mestral Bezanson et al. (2012) identified redds as residence for sockeye salmon in the Fraser River.

21. Appendix A:

    a. Escapement section: The running averages seem to be arithmetic despite log-normal distribution of the data which would suggest use of geometric running mean.

    b. Escapement section: Definitions of wild origin only, moderate enhancement, and high enhancement are needed.

Minor comments

See track changes in MSWord document

JAKE SCHWIEGERT

CSAP Working Paper 2012/13-P23

March 6-8, 2013

The authors are commended for their efforts in preparing this draft report which compiles a huge amount of data and information on the spawning escapement, exploitation rates, and estimated total population size for southern BC Chinook, and identifies threats to this species and its

habitat. The report is well written, logically organized, and easy to follow although I note there seem to be a significant number of grammatical errors that need to be corrected.

Not having a background in salmon biology or assessment I can't speak to the accuracy of the data or statements regarding the species biology but a number of general concerns arose during my reading of the report. I note that there are several ecotypes of Chinook in the area under consideration. Not only are there stream and ocean types but also within this division there are fish that return to their natal streams in the spring, summer and fall. A further sub-division appears to occur within these groupings depending on how long the juveniles stay in freshwater. Although it is the prerogative of COSEWIC to determine not only the designatable unit (DU) structure under which to conduct their assessment but they may also decide to conduct separate assessments of the status of each of these ecotypes within the DU. The task of conducting such an assessment would be simplified if the paper were to provide some guidance and recommendations on what groupings make sense biologically and the material in the appendix reorganized to group the appropriate data together, eg. arrange all the fall spawners into one appendix, the spring into another, etc. I would suggest providing similar guidance with respect to some of the other factors, for example, around habitat considerations since some ecotypes will spend less time in freshwater and the estuary so that they may be less susceptible to habitat effects such as contaminants in these areas. Similarly, the threats section should address each ecotype independently since some threats such as predation will apply more strongly to some groups than to others.

I struggled to understand the Conservation Unit aggregations. It was difficult to understand the rationale for a CU that could be as small as a kilometer (Maria Slough) or as large as several hundred kilometers (Middle Fraser) and encompass many watersheds. The middle Fraser spring and summer run CUs also appear to be comprised of several discrete watersheds and it will be difficult for COSEWIC to assess these as a single DU possibly resulting in them being further disaggregated as was done for Fraser River white sturgeon. Presumably the spreadsheet of background data would permit alternative summaries of the available escapement and run size information.

The authors provide a good description of the nuSEDS data and issues around quality. I wonder if it would be appropriate to make some recommendation about the utility of the pre-1995 data. For many systems it appears that there is little if any signal in this information for the first few decades, abundance then increases dramatically in the 1980s and early 1990s and then follows a long decline. I am unsure how one should view this early data relative to the most recent information and some comment around this issue would be useful. It seems to me that these are two disparate data sets that should not be treated as equivalent in assessing the long term trends in these populations.

With respect to the graphs of abundance by CU, it was unclear how the total abundance was determined. The report says that the data were aggregated but doesn't say how it was decided which river systems to include or exclude within each CU or how years of missing information were used in the calculation. Some additional clarification around this would be helpful. In particular, it may be of significance to the COSEWIC assessments if CUs that have large uncertainty in the quality of data are identified simply as being data deficient.

On page 33, second paragraph under marine it says that stream-type Chinook disperse widely throughout the North Pacific where they feed mainly on small fish (primarily herring and sand lance). My understanding is that ocean type Chinook tend to be coastal whereas stream-type Chinook are offshore. If that is true then herring and sandlance which are restricted to the continental shelf and inshore waters would not really be available to these fish. It would be worth reviewing the basis for this statement in Healey (1991).

I was disappointed with the habitat and threats sections which although they speak to these issues in a general sense and provide a synopsis of the threats that may impact Chinook at various life stages and environments I didn't find this particularly useful to gaining an understanding of which factors might be affecting Chinook in any particular CU. The habitat report cards in the Appendix are a step in the right direction but it would be good to know which threats are relevant to each CU and some metric to assess the magnitude. In other words, is loss of habitat an issue and if so how much has been lost, or the recent dam on the spawning river, or withdrawal of water during the summer. Clearly, this would be a monumental task and although it appears to be underway it would be helpful to include some pertinent comments in the appendices for each CU.

Table 9 and Figures 6 and 7 present information on exploitation rates on adults and survival rates of smolts. However, the reader isn't provided with any context for the information. Are the estimates within the acceptable range? Is an exploitation rate of over 60% cause for concern? Is there a target exploitation rate for fisheries in each CU? Given that CUs likely differ in productivity it is difficult to know how to interpret these data and speculate on whether these are factors affecting the increase or decrease in population abundance in the CU and should be considered a threat.

I was puzzled that only marine mammals were singled out as significant predators on Chinook. Although adults likely have a small suite of predators, juveniles must run a significant gauntlet of predators including birds and other fish both in freshwater and the marine environment. Perhaps a paragraph could be added to elaborate on that fact or at least a reference to other work, presumably part of the Cohen documentation dealt with this issue for sockeye.